

The stability of adaptive synchronization of chaotic systems

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In order to achieve identical synchronization of a network of N coupled chaotic oscillators, each node must be set to have nominally identical parameters and the N^2 elements of the adjacency matrix must be fine-tuned to ensure that the synchronous solution is admitted and stable. The analytic tool for determining whether a particular network configuration can maintain a synchronous state is given by the master stability function formulation. Recently, an adaptive strategy was presented [1] that can maintain a globally synchronous state even when the coupling strengths are unknown and time-varying. This is a distributed technique that runs at each node and employs only local information, i.e. an internal signal and an aggregate signal representing the superposition of transmitted signals from the other nodes. This adaptive synchronization strategy has been demonstrated with experiments on a network of chaotic optoelectronic oscillators [2] and with numerical simulations of large networks. In this talk, the stability of this scheme is addressed through an extension of the master stability function technique to include adaptation [3]. The results of the stability study are compared with experimental measurements.

References:

[1] F. Sorrentino and E. Ott, Phys. Rev. Lett. 100, 114101 (2008).

[2] B. Ravoori et al., Phys. Rev. E 80, 056205 (2009).

[3] F. Sorrentino et al., Chaos 20, 013103 (2010).

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